

## CLAIMS

What is claimed is:

- 1 1. A method comprising:  
2 accessing a first multi-dimensional graphical representation that describes the  
3 appearance of a plurality of points of an object from a plurality of  
4 viewing directions, the appearance varying from point to point and  
5 viewing direction to viewing direction;  
6 creating a second graphical representation that approximates the first graphical  
7 representation and that includes at least one expression having a fewer  
8 dimensions than the first multi-dimensional graphical representation by  
9 decomposing the first multi-dimensional graphical representation into  
10 the second graphical representation, the decomposing including  
11 selectively representing information from the first graphical  
12 representation.
- 1 2. The method of claim 1, further comprising expressing the first graphical  
2 representation as a matrix, and wherein creating the second graphical  
3 representation includes using singular value decomposition to decompose the  
4 first multi-dimensional graphical representation into a first vector multiplying a  
5 second vector.
- 1 3. The method of claim 1, wherein creating by decomposing includes selectively  
2 representing information from the first graphical representation that is most  
3 important to describe the appearance of the object and neglecting redundant  
4 information from the first graphical representation that is less important to  
5 describe the appearance of the object.

1 4. The method of claim 1, further comprising:  
 2 accessing a third multi-dimensional graphical representation that describes the  
 3 appearance of a second plurality of points of the object from a plurality  
 4 of viewing directions, the second plurality of points including the first  
 5 plurality of points, and the appearance varying from point to point and  
 6 viewing direction to viewing direction; and  
 7 partitioning the third multi-dimensional graphical representation into a  
 8 plurality of smaller multi-dimensional graphical representations each  
 9 associated with a primitive of a polygonal representation of the  
 10 geometry of the object, the plurality of smaller multi-dimensional  
 11 graphical representations including the first multi-dimensional  
 12 graphical representation.

1 5. A method comprising:  
 2 accessing a first graphical representation that describes the appearance of a  
 3 plurality of points on an object;  
 4 creating a second graphical representation based on the first graphical  
 5 representation, the second graphical representation containing less  
 6 redundant descriptive information than the first graphical  
 7 representation, and the second graphical representation containing a  
 8 plurality of portions that are capable of being concurrently combined to  
 9 display the plurality of points of the object with an appearance  
 10 associated with a particular viewing direction.

1 6. The method of claim 5, wherein the first graphical representation describes the  
 2 appearance of a plurality of points of an object from a plurality of viewing



5 points, and the appearance varying from point to point and viewing  
6 direction to viewing direction; and  
7 partitioning the third graphical representation into a plurality of smaller  
8 graphical representations each associated with at least one primitive of  
9 a polygonal representation of the geometry of the object, the plurality  
10 of smaller multi-dimensional graphical representations including the  
11 first multi-dimensional graphical representation.

1 12. A machine-readable medium having stored thereon data representing  
2 sequences of instructions that when executed cause a machine to perform  
3 operations comprising:  
4 accessing a first graphical representation that describes the appearance of a  
5 plurality of points on an object;  
6 creating a second graphical representation based on the first graphical  
7 representation, the second graphical representation containing less  
8 redundant descriptive information than the first graphical  
9 representation, and the second graphical representation containing a  
10 plurality of portions that are capable of being concurrently combined to  
11 display the plurality of points of the object with an appearance  
12 associated with a particular viewing direction.

1 13. The machine-readable medium of claim 12, wherein the instructions for  
2 accessing the first graphical representation further comprise instructions  
3 causing the machine to perform operations comprising accessing a first  
4 graphical representation that describes the appearance of a plurality of points  
5 of an object from a plurality of viewing directions, the appearance varying  
6 from point to point and viewing direction to viewing direction.

1 14. The machine-readable medium of claim 12, wherein the instructions for  
2 creating further comprise instructions causing the machine to perform  
3 operations comprising creating a second graphical representation that includes  
4 a plurality of portions capable of being expressed as matrices.

1 15. The machine-readable medium of claim 12, wherein the instructions for  
2 creating further comprise instructions causing the machine to perform  
3 operations comprising creating a second graphical representation that includes  
4 a plurality of portions that can be combined using multitexturing hardware that  
5 allows multiple textures to be concurrently applied to a primitive in a single  
6 rendering pass.

1 16. The machine-readable medium of claim 12, wherein the instructions for  
2 creating further comprise instructions causing the machine to perform  
3 operations comprising creating a second graphical representation that includes  
4 a plurality of portions that are capable of being concurrently combined without  
5 decompressing the plurality of portions.

1 17. The machine readable medium of claim 12, wherein the instructions further  
2 comprise instructions causing the machine to perform operations comprising:  
3 accessing a third graphical representation that describes the appearance of a  
4 second plurality of points of the object from a plurality of viewing  
5 directions, the second plurality of points including the first plurality of  
6 points, and the appearance varying from point to point and viewing  
7 direction to viewing direction; and  
8 partitioning the third graphical representation into a plurality of smaller  
9 graphical representations each associated with at least one primitive of

10 a polygonal representation of the geometry of the object, the plurality  
11 of smaller multi-dimensional graphical representations including the  
12 first multi-dimensional graphical representation.

1 18. A method comprising:  
2 accessing image-based data for an object that describes the appearance of the  
3 object from a plurality of viewing directions;  
4 dividing the image-based data into a plurality of smaller portions associated  
5 with regions on the object;  
6 standardizing each of the plurality of smaller portions;  
7 creating a plurality of approximate graphical representations that approximate  
8 the plurality of standardized portions by selectively representing certain  
9 non-redundant information from each of the plurality of standardized  
10 portions; and  
11 storing each of the plurality of approximate graphical representations.

1 19. The method of claim 18:  
2 wherein dividing the image-based data includes partitioning the image-based  
3 data into a plurality of subsets of image-based data, each subset of  
4 image-based data describing the appearance of a primitive-defined  
5 region of the object for a particular viewing direction, each subset  
6 having a higher degree of spatial coherency than the set of image-based  
7 data;  
8 wherein standardizing includes normalizing the size of each of the plurality of  
9 subsets of image-based data to a predetermined size, normalizing the  
10 shape of each of the plurality of subsets of image-based data to a  
11 predetermined shape, and using the plurality of subsets of image-based

12 data to compute a resampled plurality of subsets of image-based data  
13 that correspond to predetermined standardized viewing directions; and  
14 wherein creating a plurality of approximate graphical representations includes  
15 creating for each primitive-defined region a first data structure that is  
16 independent of the viewing direction and a second data structure that  
17 includes a plurality of portions that each correspond to a different  
18 viewing direction.

1 20. The method of claim 18, further comprising:  
2 acquiring geometry data for an object that describes the geometric extents of  
3 the surface of the object;  
4 converting the geometry data into a geometric representation of the geometry  
5 of the object; and  
6 acquiring image-based data that describes the appearance of the surface of the  
7 object from a plurality of viewing directions.

1 21. The method of claim 18, further comprising:  
2 receiving a request for graphical content associated with the object from  
3 another computer system;  
4 transmitting a plurality of approximate graphical representations to the other  
5 computer system; and  
6 transmitting geometry data for the object to the other computer system.

1 ~~22.~~ A data structure comprising at least a first portion and a second portion, the  
2 second portion including a second plurality of view-dependent subportions  
3 including a first view-dependent subportion that corresponds to a first viewing  
4 direction and a second view-dependent subportion that corresponds to a second

5 viewing direction, wherein the first portion and the first view-dependent  
6 subportion are combinable using multitexturing hardware that allows multiple  
7 textures to be concurrently applied to a primitive in a single rendering pass to  
8 display a plurality of points of an object with a first appearance corresponding  
9 to a first viewing direction, and wherein the first portion and the second view-  
10 dependent subportion are combinable using the multitexturing hardware to  
11 display the plurality of points of the object with a second appearance  
12 corresponding to a second viewing direction.

1 23. The data structure of claim 22, wherein the data structure is derived from a  
2 plurality of images acquired for the object by selectively representing  
3 information from the plurality of images that is important to describe the  
4 appearance of the object and selectively removing information from the  
5 plurality of images that is redundant.

1 24. The data structure of claim 22, wherein the first portion and the first view-  
2 dependent subportion are combinable without decompression using the  
3 multitexturing hardware.

1 25. The data structure of claim 22, wherein the first portion and the second portion  
2 are created by decompressing a corresponding compressed first portion and a  
3 corresponding compressed second portion of another data structure.

1 ~~26.~~ A data structure comprising a plurality of portions that are combinable without  
2 interpolation to display a plurality of points of the object with a first  
3 appearance for a first viewing direction and display the plurality of points with  
4 a second appearance for a second viewing direction.



1 27. The data structure of claim 26, the data structure being derived from a plurality  
2 of images acquired for an object by representing important information that  
3 describes the appearance of the object and removing redundant information  
4 associated with the plurality of images.

1 28. The data structure of claim 26, wherein the plurality of portions are  
2 combinable without decompression.

1 29. The data structure of claim 26, wherein the plurality of portions are created by  
2 decompressing corresponding compressed portions of another data structure.

1 30. The data structure of claim 26, wherein the plurality of portions include a first  
2 matrix and a second matrix that are concurrently combinable using  
3 multitexturing hardware that allows multiple textures to be concurrently  
4 applied to a primitive in a single rendering pass.